

STUDY OF EXTERNAL NEUTRON SOURCE FOR ACCELERATOR DRIVEN SYSTEM BY GENERAL-PURPOSE PARTICLES AND HEAVY ION TRANSPORT MONTE CARLO CODE PHITS

TAKANORI SUGAWARA, TAKASHI CHIBA, TOMOHIKO IWASAKI

Tohoku University

Recently, accelerator-driven subcritical system (ADS) has been studied as a useful neutron source for partitioning and transmutation of minor actinides. A subcritical core of ADS is driven by external neutron source (S), which is generated by the spallation reaction. Although S will be suffered from the changes of the core parameters such as coolant void generation, in previous study, the changes are not taken into account for an analysis of ADS. In the present study, we studied the effects to S of the following core parameters; Incident proton energy (0.5GeV 2.0GeV), beam diameter (0~10cm), void generation in target (0%~50%), void generation in coolant region (0%~70%), and the level position of target surface (25cm). The calculations in this study were performed by General-Purpose particle and heavy ion transport Monte Carlo code PHITS, which has been developed at JAERI and Tohoku University based on NMTC/JAM. An ADS core of U-Pu-MA fuel and Pb-Bi coolant was employed for the analysis in the present study.

As the results, the following effects to S by the changes of the core parameters was observed.

1. Energy change: the change exceeds factor 10 and the distribution of S in the ADS core was almost the same in shape.

2. Beam diameter: the difference of S was within 10% and the distribution of S was almost the same.

3. Void generation in target region: the change of S was factor 3 at the maximum and the distribution was changed especially for z direction.

4. Void generation in coolant region: the effect was within 50% and the distribution changed largely.

5. target level: the difference was factor 2 and the distribution was varied very large.

It is found that the effects of the core parameter to S are very large in magnitude and shape. The S variation for dynamics behavior and core performance of an ADS should be considered in an ADS study.